Space Weather Technical Forecast

Issued on Monday, 23 October 2023 at 01:11 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity as recorded at GOES16 has been Very Low over the past 24 hours, with no significant flares seen, and with background X-ray flux steady in mid-B-class - a trace reminiscent of solar minimum. There are currently up to five sunspot regions on the visible disc, all of which are small, magnetically simple and stable.

The only coronagraph activity in the period was far-sided: both from beyond the western limb but also a notably large prominence eruption from the northeast around 22/2200UTC. No Earth-directed CMEs have been seen in imagery during the last 24 hours.

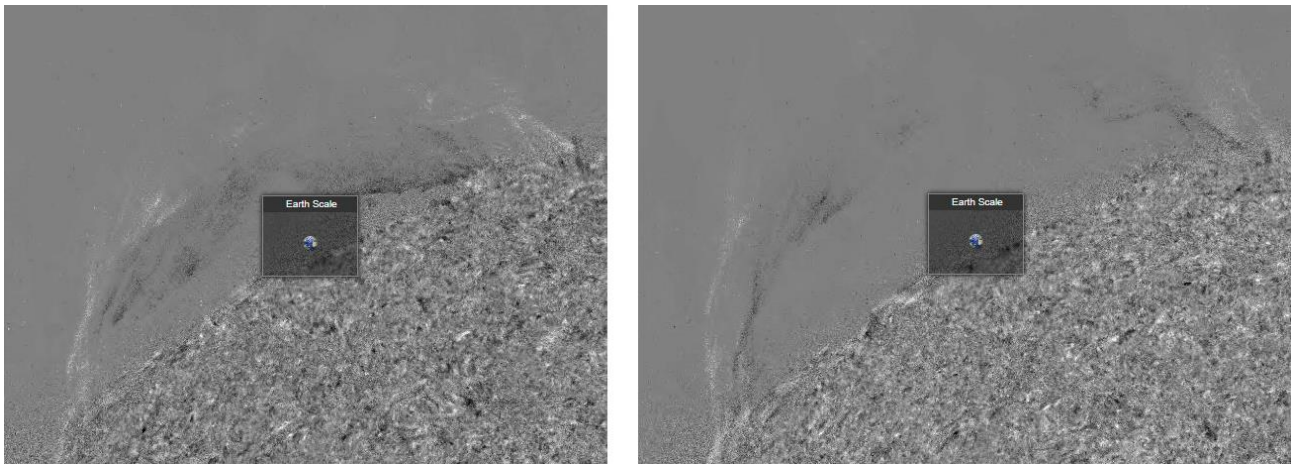

Figure 0: Helioviewer.org AIA304 15-minute cadence difference imagery of a large far-sided prominence eruption, starting around 22/2200UTC. Earth shown for scale.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE at L1, was a little disturbed but with an uncertain mechanism. There were slight discontinuities evident at 22/0300UTC in IMF and at 22/1000UTC in phi and speed. ACE EPAM LEMS decreased after 22/1000UTC. Overall, glancing incidence from a CME shock early in the period is not beyond possibility, perhaps with later entry into a minor negative polarity fast wind, although the latter is uncertain as the density did not fall as sharply as would normally be expected.

The solar wind speed showed an overall upward trend, rising from 275 to finish near 350km/s, with much of this rise occurring after 22/1500UTC. The solar wind density rose slightly early in the period, but soon plateaued without departing from single figures ppcc, i.e. within background. The IMF was somewhat erratic in character and magnitude, peaking at a Slightly Elevated 9nT, with the north-south component varying between +7 and -9nT. The phi angle was mixed until 22/1000UTC, whereupon it settled on a mainly negative direction (towards the Sun).

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The net result of the above solar wind measures was nevertheless provisionally Quiet throughout, peaking at 2+ in the 18-21UTC interval.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at Background levels.

GOES16 high energy (greater than 2MeV) electron flux was predominantly at Normal Background levels. The associated 24-hour fluence was well below the Active (1e8 integrated pfu) threshold. The observation at 23/0001UTC was 1.82e6 integrated pfu.

Four-Day Space Weather Forecast Summary

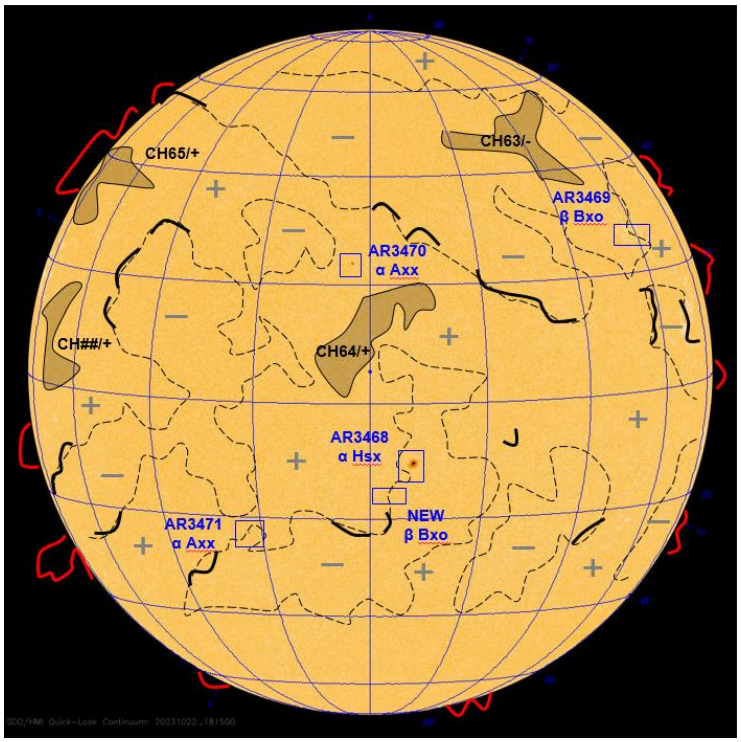
Solar Activity: Solar activity is expected to remain Low or Very Low, with a Slight Chance of isolated C-Class flares that may increase a little through the coming UTC working week.

Solar Wind / Geomagnetic Activity: No significant CMEs feature in the forecast. The forecast is for mainly Quiet geomagnetic activity. Up to two fast wind streams are due, a low confidence and low impact feature perhaps due later in the first 24 hours, and then a more probable Slight Chance of G1 arising from a second coronal hole after midweek UTC.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at Background levels.

High energy electron flux (greater than 2MeV) is expected to remain at Normal Background levels, with a Slight Chance of a late rise from CH64's fast wind.

Figure 1. Solar Analysis Valid 22/1815UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No significant CMEs feature in this four-day period.

The coronal hole forecast is not likely to be significantly impactful in the coming four days. No coronal hole on last pass significantly surpassed 500km/s, and there are no major intensifications in EUV since then, and we are relatively further from the equinox to damp the contribution from positive polarity features a little.

The forecast comprises early potential influence from CH63/- and then late influence from CH64/+. CH63/- is the lower confidence feature for both presence and impacts, given its high solar latitude and its negative polarity. CH64/+ may then round out the four days with arrival from late day three (Wednesday 25 October), but is perhaps more likely on Thursday 26 October, with Elevated solar winds possible. This is a positive polarity feature and may give a greater risk of geomagnetic enhancement at this time of year.

Geomagnetic activity is likely to be mainly Quiet in the coming four days, but there is a peak risk of Active intervals to start and especially end the period from the two coronal holes, with the later feature carrying a peak Slight Chance of attaining G1.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	5	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

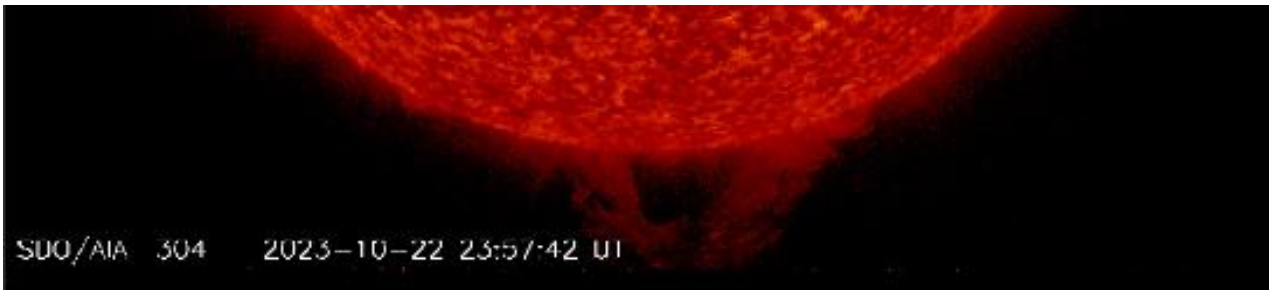

Figure 2: A second major prominence eruption, seen in AIA304 imagery at the very end of the past 24-hour reporting period. This is not expected to affect Earth.

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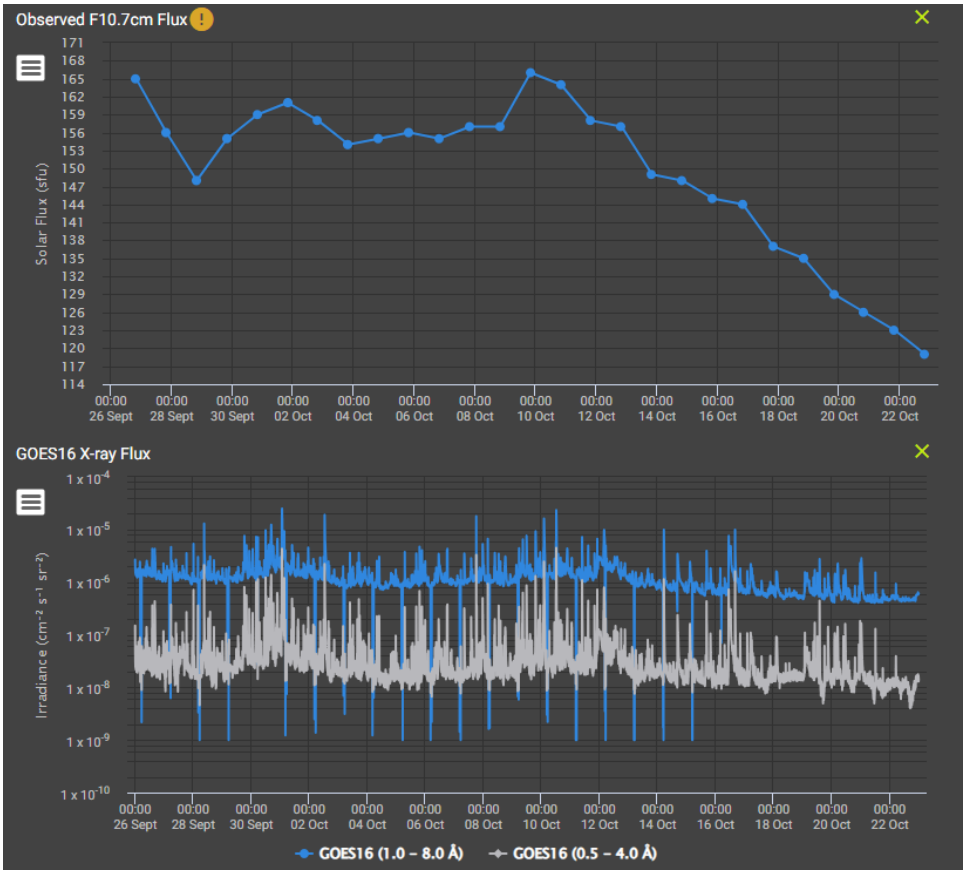
Radio Blackouts - X-Ray Flares:

There are currently just five potential sunspots on the Earth-facing disc, and these are all stable and small unipolar or simple bipolar groups.

There are hints in extreme UV imagery that a new region may now lie on the northeastern limb. Given the current very subdued front-side and prospect of arrivals from far side sounding signals, a 'regression to the mean' of an increasing Slight Chance of M-class flares is most likely in the four days.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	5	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: Penticton 10.7cm flux trend over the past month and GOES16 X-ray flux for same period. The most recent value for 10.7cm flux is in fact a minimum for the current calendar year.



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Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels in the absence of significant regions on the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

Electron flux observed by GOES16 at GEO is currently at Normal Background levels and is very likely to remain here given the expected relative lack of CMEs and modest potency of inbound coronal holes' fast winds - at least until the possible late arrival of CH64/+.

Persistence forecasting is polluted by CMEs from last pass, however the latest MOSWOC REFM is almost unmoved from current 24-hour fluence levels across its full 72-hour range. This may be expected to show more of an uptick as it comes to encompass the coming UTC day of Thursday in the next 24 hours, with the predecessor of CH64/+'s fast wind beginning to show, however even this will probably fall short of Active.

Any increase in 24-hour fluence is therefore not likely to manifest until the close the current UTC working week, with perhaps a Slight Chance on Thursday 26 October, should the fast wind arrive on the early end of estimates around midweek UTC.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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